App. No. 10/064,230
Amendment (supplemental) dated June 3, 2003
Reply to Office action of January 17, 2003

This listing of claims will replace the prior version of the claims in the present application.

Listing of Claims:

Claim 1 (currently amended): A spindle motor comprising:
a shaft;
a round cone portion being a part of said shaft, and whose diameter changes evenly along said shaft longitudinally;
an approximately disk-shaped hub mounted on one end of, for rotating together with, said shaft, said hub having a disk-mounting portion on one side thereof;
a rotor magnet mounted on the peripherally outer margin of said hub opposite the disk-mounting side;
a stator installed opposing a radial edge face of said rotor magnet;
a conical cavity whose opening changes in diameter evenly along said shaft longitudinally, to correspond in contour to said cone portion, for accommodating said cone portion, said conical cavity having a base corresponding to the narrower end of said cone portion and an inner peripheral surface opposing a lateral surface of said cone portion across an approximately uniform gap;
a member including said conical cavity;
oil filling a clearance, including the approximately uniform gap, between said cone portion and said conical cavity, wherein said oil is retained continuously without interruption; and
one and only one dynamic-pressure bearing formed in said gap, between the lateral surface of said cone portion and the inner peripheral surface of said conical cavity opposing the lateral surface, said dynamic-pressure bearing including, on at least either said lateral surface of said cone portion or said inner peripheral surface of said conical cavity, grooves provided in one and only one set unbroken axially and in unbalanced herringbone or spiral form, configured so as to heighten pressure heading toward the base of said conical cavity.

Claim 2 (original): The spindle motor set forth in claim 1, further including a magnetic biasing means acting in a direction counter to thrust-directed bearing force generated by action of said dynamic-pressure bearing, and cooperating with said dynamic-pressure bearing to support said shaft and said member rotating one relative to the other.

Claim 3 (original): The spindle motor set forth in claim 2, wherein:
said conical cavity at its mouth is closed over by a disk-shaped cover having an aperture through which said shaft is inserted; and
a gas-liquid interface on said oil is positioned in between an upper face of said cone portion and an undersurface of said disk-shaped cover.

Claim 4 (original): The spindle motor set forth in claim 1, wherein a recess for capturing foreign matter mixed into said oil is formed in the approximate mid-area of the bottom portion of said conical cavity.

Claim 5 (currently amended): A spindle motor comprising:
a shaft;
a round cone portion being a part of said shaft, and whose diameter changes evenly along said shaft longitudinally;
an approximately disk-shaped hub mounted on one end of, for rotating together with, said shaft, said hub having a disk-mounting portion on one side thereof;
a rotor magnet mounted on the peripherally outer margin of said hub opposite the disk-mounting side;
a stator installed opposing a radial edge face of said rotor magnet;
a conical cavity whose opening changes in diameter evenly along said shaft longitudinally, to correspond in contour to said cone portion, for accommodating said cone portion, said conical cavity having a base corresponding to the wider end of said cone portion and;
a member including said conical cavity;
a clearance between said cone portion and said conical cavity;
oil filling said clearance continuously; and
one and only one dynamic-pressure bearing formed in said ~~gap~~ clearance, between a lateral surface of said cone portion and an inner peripheral surface of said conical cavity opposing the lateral surface, said dynamic-pressure bearing including, on at least either said lateral surface of said cone portion or said inner peripheral surface of said conical cavity, grooves provided in one and only one set unbroken axially and in unbalanced herringbone or spiral form, configured so as to heighten pressure heading toward the base of said conical cavity; wherein
said cone portion diametrically expands heading toward the base of said conical cavity.

Claim 6 (new): A spindle motor comprising:
a shaft fixedly fitted into a bracket;
a round cone portion being a part of said shaft, and whose diameter changes evenly along said shaft longitudinally;
an approximately disk-shaped hub disposed concentrically about said round cone portion, said hub radially outwardly having a disk-mounting portion on one side thereof and centrally having a flat-based conical cavity whose opening changes in diameter evenly along said shaft longitudinally, to correspond in contour to and accommodate said cone portion at an approximately uniform gap between said conical cavity along its inner peripheral surface opposing said cone portion along its lateral surface;
a rotor magnet mounted on the other side of said hub;
a stator installed opposing a radial edge face of said rotor magnet;
oil filling a clearance, including the approximately uniform gap, between said cone portion and said conical cavity, wherein said oil is retained continuously without interruption; and
one and only one dynamic-pressure bearing formed in said gap, between the lateral surface of said cone portion and the inner peripheral surface of said conical cavity opposing the lateral surface, said dynamic-pressure bearing including, on at least either said lateral surface of said cone portion or said inner peripheral surface of said conical cavity, grooves in unbalanced herringbone or spiral form, configured so as to heighten pressure heading toward the base of said conical cavity; wherein

said cone portion either diametrically expands or diametrically contracts heading toward the base of said conical cavity.

Claim 7 (new): The spindle motor set forth in claim 6, further including a magnetic biasing means acting in a direction counter to thrust-directed bearing force generated by action of said dynamic-pressure bearing, and cooperating with said dynamic-pressure bearing to support said shaft and said member rotating one relative to the other.

Claim 8 (new): The spindle motor set forth in claim 7, wherein:
said conical cavity at its mouth is closed over by a disk-shaped cover having an aperture through which said shaft is inserted; and
a gas-liquid interface on said oil is positioned in between an upper face of said cone portion and an undersurface of said disk-shaped cover.

Claim 9 (new): The spindle motor set forth in claim 6, wherein a recess for capturing foreign matter mixed into said oil is formed in the approximate mid-area of the bottom portion of said conical cavity.

Claim 10 (new): A spindle motor comprising:
a shaft;
a conic frustum portion being a part of said shaft, and whose diameter changes evenly along said shaft longitudinally, said conic frustum portion defining a frustum height;
an approximately disk-shaped hub mounted on one end of, for rotating together with, said shaft, said hub having a disk-mounting portion on one side thereof;
an annular rotor magnet mounted on the other side of said hub;
a stator installed opposing a radial edge face of said rotor magnet;
a sleeve member containing a conical cavity whose opening changes in diameter evenly along said shaft longitudinally, to correspond in contour to said conic frustum portion, for accommodating said conic frustum portion in its entirety, said conical cavity having a base corresponding to the narrower end of said conic frustum portion and an inner peripheral surface opposing a lateral surface of said conic frustum portion across an approximately uniform gap;
oil filling a clearance, including the approximately uniform gap, between said conic frustum portion and said conical cavity, wherein said oil is retained continuously without interruption; and
one and only one dynamic-pressure bearing formed in said gap, between the lateral surface of said conic frustum portion and the inner peripheral surface of said conical cavity opposing the lateral surface, said dynamic-pressure bearing including, on at least either said lateral surface of said conic frustum portion or said inner peripheral surface of said conical cavity, grooves in unbalanced herringbone or spiral form, configured so as to heighten pressure heading toward the base of said conical cavity; wherein
said conic frustum portion is configured such that said frustum height is less than one-half the radius of said annular rotor magnet.

Claim 11 (new): A spindle motor comprising:
a shaft;
a conic frustum portion being a part of said shaft, and whose diameter changes evenly along said shaft longitudinally, said conic frustum portion defining a frustum height;
an approximately disk-shaped hub mounted on one end of, for rotating together with, said shaft, said hub having a disk-mounting portion on one side thereof;
an annular rotor magnet mounted on the other side of said hub;
a stator installed opposing a radial edge face of said rotor magnet;
a sleeve member containing a conical cavity whose opening changes in diameter evenly along said shaft longitudinally, to correspond in contour to said conic frustum portion, for accommodating said conic frustum portion in its entirety, said conical cavity having a base corresponding to the wider end of said conic frustum portion and;
a clearance between said conic frustum portion and said conical cavity;
oil filling said clearance continuously; and
one and only one dynamic-pressure bearing formed in said clearance, between a lateral surface of said conic frustum portion and an inner peripheral surface of said conical cavity opposing the lateral surface, said dynamic-pressure bearing including, on at least either said lateral surface of said conic frustum portion or said inner peripheral surface of said conical cavity, grooves in unbalanced herringbone or spiral form, configured so as to heighten pressure heading toward the base of said conical cavity; wherein
said conic frustum portion diametrically expands heading toward the base of said conical cavity, and
said conic frustum portion is configured such that said frustum height is less than one-half the radius of said annular rotor magnet.

Claim 12 (new): A spindle motor comprising:
a shaft fixedly fitted into a bracket;
a conic frustum portion being a part of said shaft, and whose diameter changes evenly along said shaft longitudinally;
an approximately disk-shaped hub disposed concentrically about said conic frustum portion, said hub radially outwardly having a disk-mounting portion on one side thereof and centrally having a flat-based conical cavity whose opening changes in diameter evenly along said shaft longitudinally, to correspond in contour to and accommodate in its entirety said conic frustum portion at an approximately uniform gap between said conical cavity along its inner peripheral surface opposing said conic frustum portion along its lateral surface;
an annular rotor magnet mounted on the other side of said hub;
a stator installed opposing a radial edge face of said rotor magnet;
oil filling a clearance, including the approximately uniform gap, between said conic frustum portion and said conical cavity, wherein said oil is retained continuously without interruption; and
one and only one dynamic-pressure bearing formed in said gap, between the lateral surface of said conic frustum portion and the inner peripheral surface of said conical cavity opposing the lateral surface, said dynamic-pressure bearing including, on at least either said lateral surface of said conic frustum portion or said inner peripheral surface of said conical cavity, grooves

in unbalanced herringbone or spiral form, configured so as to heighten pressure heading toward the base of said conical cavity; wherein
said conic frustum portion either diametrically expands or diametrically contracts heading toward the base of said conical cavity, and
said conic frustum portion is configured such that said frustum height is less than one-half the radius of said annular rotor magnet.